

The First Story of LG Innotek: Essential Solutions to Achieve Full Autonomous Driving

# LiDAR: the Eye of Autonomous Driving

How LG Innotek's deep production experience efficiently helps to achieve sight for self-driving cars

\*LiDAR: Light Detection And Ranging

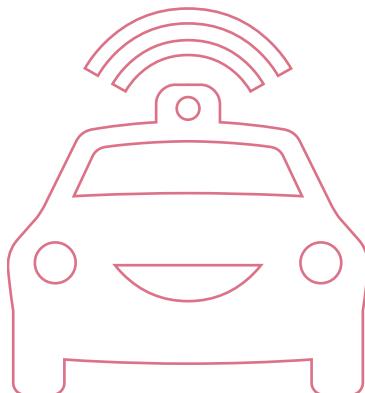


## Table of Contents

1. Executive Summary
2. The Future of Autonomous Driving
3. The Essence of Autonomous Driving, LiDAR
  - What is LiDAR?
  - Why LiDAR?
4. Five Challenges of LiDAR Production
5. The Answer is LG Innotek
  - Rich Experience in Production and Design
  - Providing Integrated Autonomous Driving Solutions
6. Coming Up Next



# Executive Summary



Self-driving cars are at the core of the future automotive industry. Experts in the industry predict that by the year 2025, vehicles with conditional automation (Lv. 3) will be widely popularized and vehicles featuring high automation (Lv. 4) will be introduced. In preparation, key players in the automotive industry are focused on unlocking breakthrough technologies to secure a leadership position in the autonomous market.

Backed by stable and customized manufacturing paired with cost competitiveness, LG Innotek is primed to take on a leadership position in commercializing LiDAR in autonomous vehicles.

## Precise assembly and packaging

As a mobile camera module market leader, LG Innotek has accumulated capabilities in optical design and production over many years. This experience built a competitive edge in the handling of advanced and precise LiDAR active alignment technologies operated through a combination of Tx<sup>1)</sup> and Rx<sup>2)</sup>.

## Manufacturing capacity for mass production

In addition to its mass-production capabilities and various certifications in automotive electronic parts, LG Innotek has optimized the overall value chain by adopting digital technologies based on AI. LG Innotek has secured its optimal manufacturing process by leveraging a connected digital system comprised of its Digital Twin software, smart factory, and data expertise.

## Cost competitiveness

LG Innotek has secured cost competitiveness through its optimized mass production design capabilities.

## Test and validation

Quality is ensured through the optical and functional tests of NIR<sup>3)</sup>/SWIR<sup>4)</sup> transceivers. Additionally, a customized test station is developed for each Tx, Rx Transceiver.

## Automotive business network

More than a decade of experience developing and producing automotive components has built a broad network of customers and vendors.

Sophisticated and complex sensing technologies are essential to the development of fully autonomous cars (Lv. 4/Lv. 5). LG Innotek is prepared to provide partners with autonomy solutions such as LiDAR, RADAR<sup>5)</sup>, and other camera and connectivity modules, in addition to the motor, power, and lighting components it already supplies.

Starting with LiDAR, we plan to share more insights on autonomous vehicles, E-mobility, and overall trends in the car component industry through this regular newsletter.

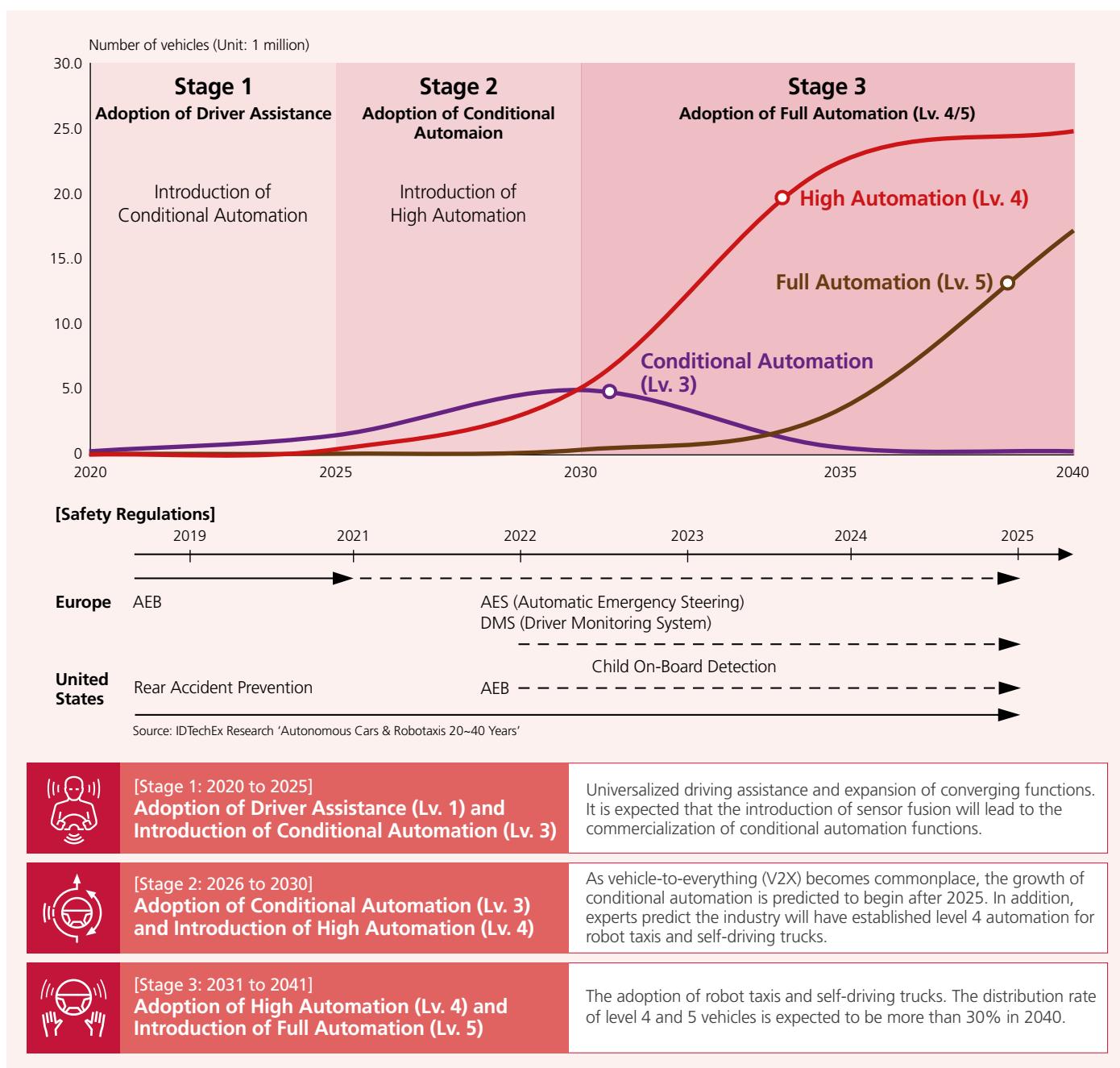


To develop an autonomous car with a rating of level 4 or higher—achieved only when a vehicle requires no driver intervention—so sophisticated and complex sensing technologies are necessary. Technologies such as these combine multiple cameras, LiDAR, RADAR, and much more. Currently, car manufacturers are striving to secure such technology to enter the market with level 4 autonomous vehicles. Specifically, manufacturers are investing in LiDAR technology which will be foundational to the commercialization of level 4+ autonomous vehicles. This concerted effort by manufacturers reflects that, in addition to helping achieve level 4+ autonomy, it is essential that LiDAR solutions are suitable for and reliable in automotive environments, and the means of production are cost-effective.



## The Future of Autonomous Driving

Universally, engineers sort autonomous vehicles into five categories or stages: three of the most critical include driver assistance, conditional automation, and full automation. Looking forward, market experts predict the distribution rate of conditional/full automation to be more than 30% in 2040.



LG Innotek provides high-tech solutions such as LiDAR, Camera, RADAR, and connectivity modules.

This first edition of newsletter covers the essential nature of LiDAR and the requirements for its mass production.



# The Essence of Autonomous Driving, LiDAR

## WHAT IS LiDAR?

LiDAR is a sensing solution that utilizes point cloud technology for improved sensing performance compared to cameras and RADAR alone.

LiDAR is classified based on two criteria: the scanning method (Mechanical LiDAR, Solid-State LiDAR) and the ranging method (ToF<sup>6)</sup>, FMCW<sup>7)</sup>.



## WHY LiDAR?

In addition to improving object recognition ability, LiDAR technology senses situations that cameras cannot and has several distinct advantages.

First, LiDAR provides three-dimensional information on objects across a broader plane. Suppose a driver were to lose sight temporarily when traveling from a dark environment, like a tunnel, to a bright one. In that case, LiDAR outperforms multi-camera systems and lowers the possibility of an accident.

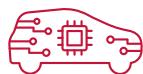
Secondly, LiDAR uses an invisible infrared light source to sense objects in a driver's blind spot without disrupting other drivers. This feature is particularly useful when driving at night on dimly lit streets.

Lastly, LiDAR uses a NIR/SWIR (850 - 1550 nm) light source to offer better visibility than a camera in bad weather such as fog and rain.

The most significant advantage of LiDAR is that it recognizes objects in 3D and processes essential information about the object itself and its distance from the vehicle.

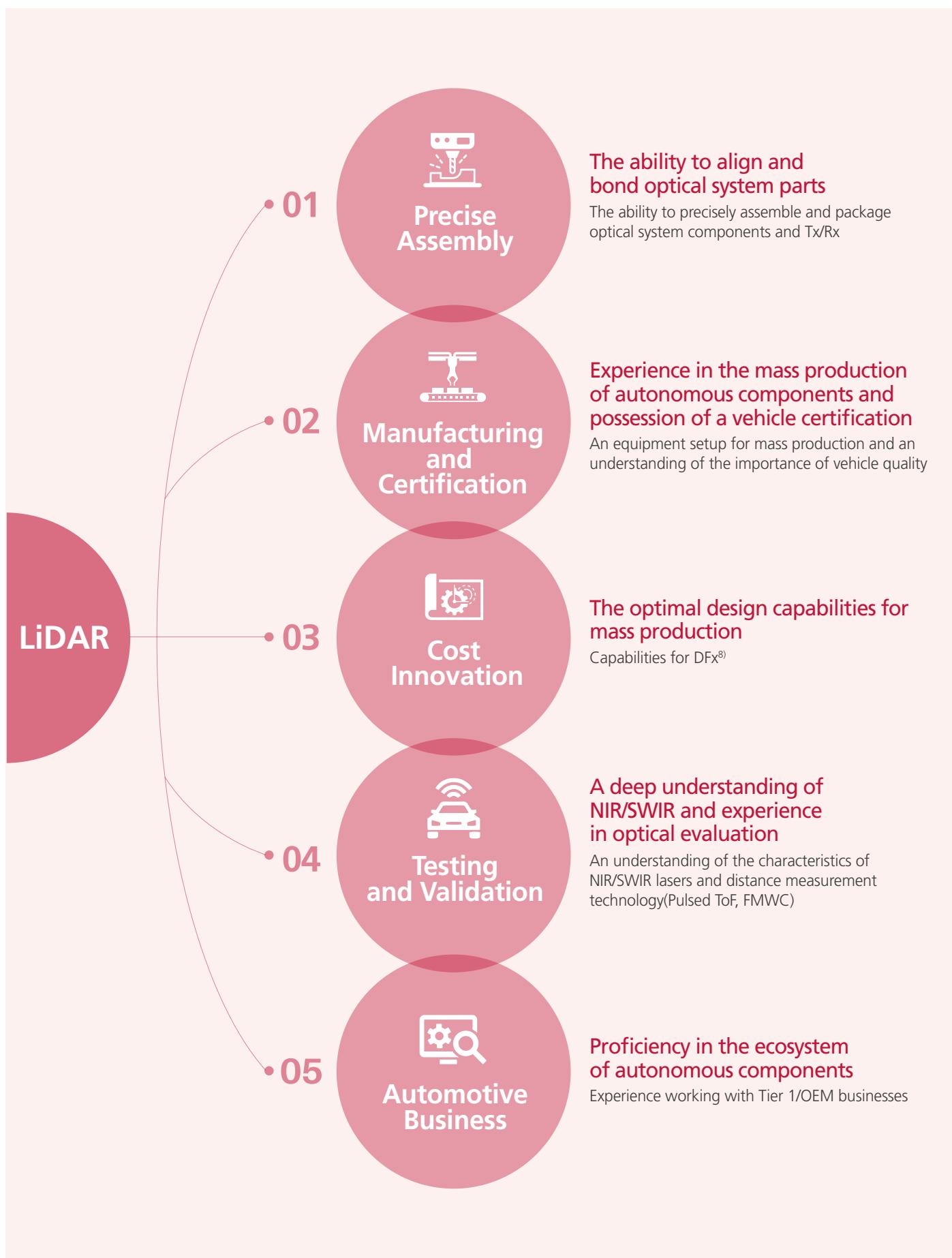


To commercialize self-driving vehicles, manufacturers must develop autonomous systems that can successfully identify, assess, and respond to risks better than a human. Ultimately, the ability to recognize a dangerous situation is paramount and drives the adoption of LiDAR in autonomous driving systems.



# Five Challenges of LiDAR Production

In order to secure stable LiDAR production, manufacturers must consider the following five factors.





# The Answer is “LG Innotek”

## Rich Experience in Production and Design

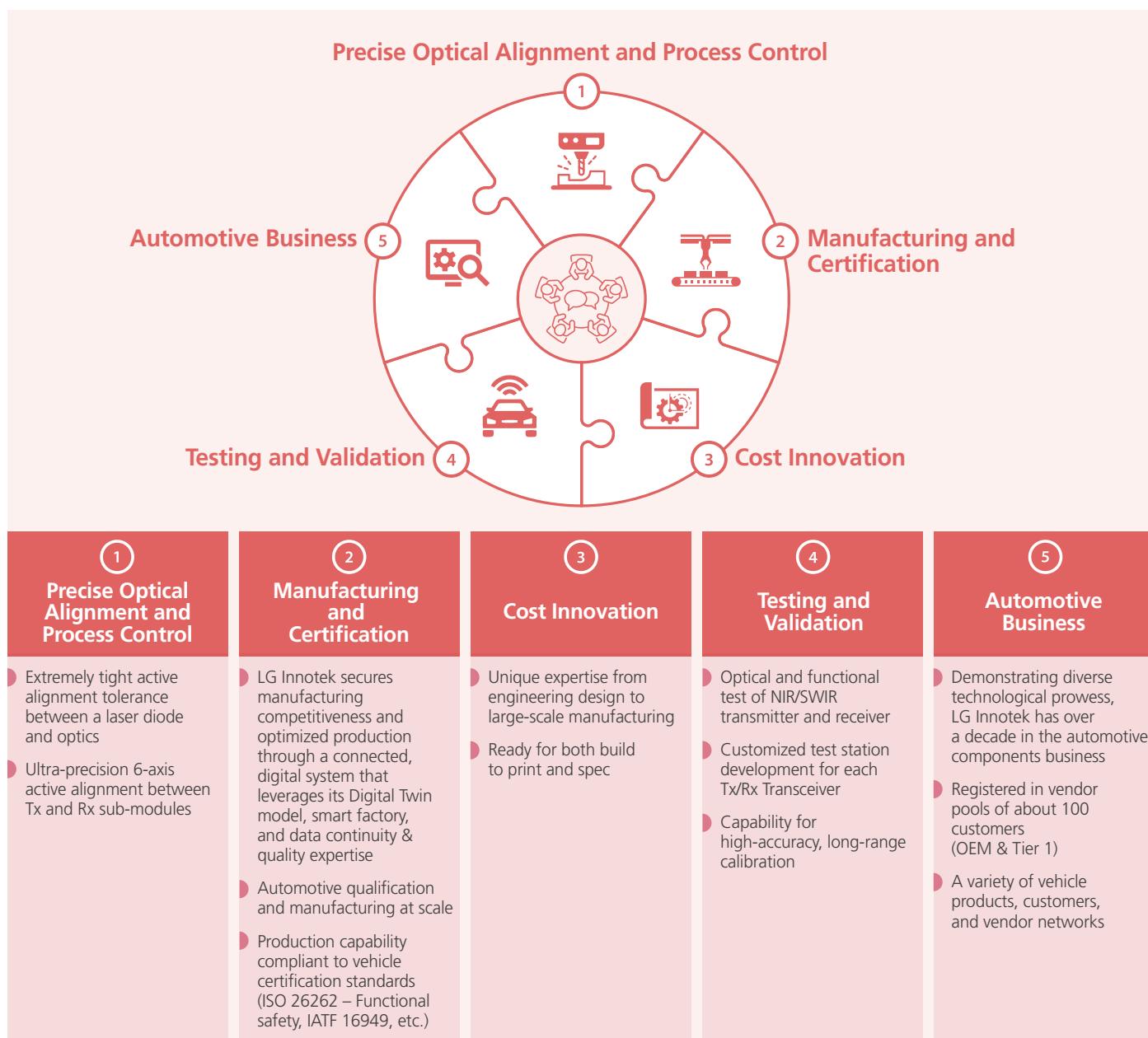
In addition to solidifying its position as a major supplier in the smartphone camera module market, LG Innotek provides significant consumer value for LiDAR commercialization via optical system design and production technologies secured through its camera business.

As for smartphone camera modules, multi-camera functions such as zoom, wide-angle, and telephoto have been the trends for a long time. As such, LG Innotek has already secured capabilities appropriate for automation through optical system alignment design and production technology—the keys to ensuring reliable multi-camera performance. Though a combination of Tx and Rx, LG Innotek provides a solution that enables customers to secure high-quality product output in the development of LiDAR.

Moreover, LG Innotek has diverse experience in the automotive business, producing key components for electric and self-driving cars such as motors, power modules, connectivity modules, cameras, and lamps for global car manufacturers since 2007.

In particular, it is essential that LiDAR manufacturers leverage technology to lower production costs while ensuring reliable automotive performance, making LG Innotek a sought-after LiDAR partner.

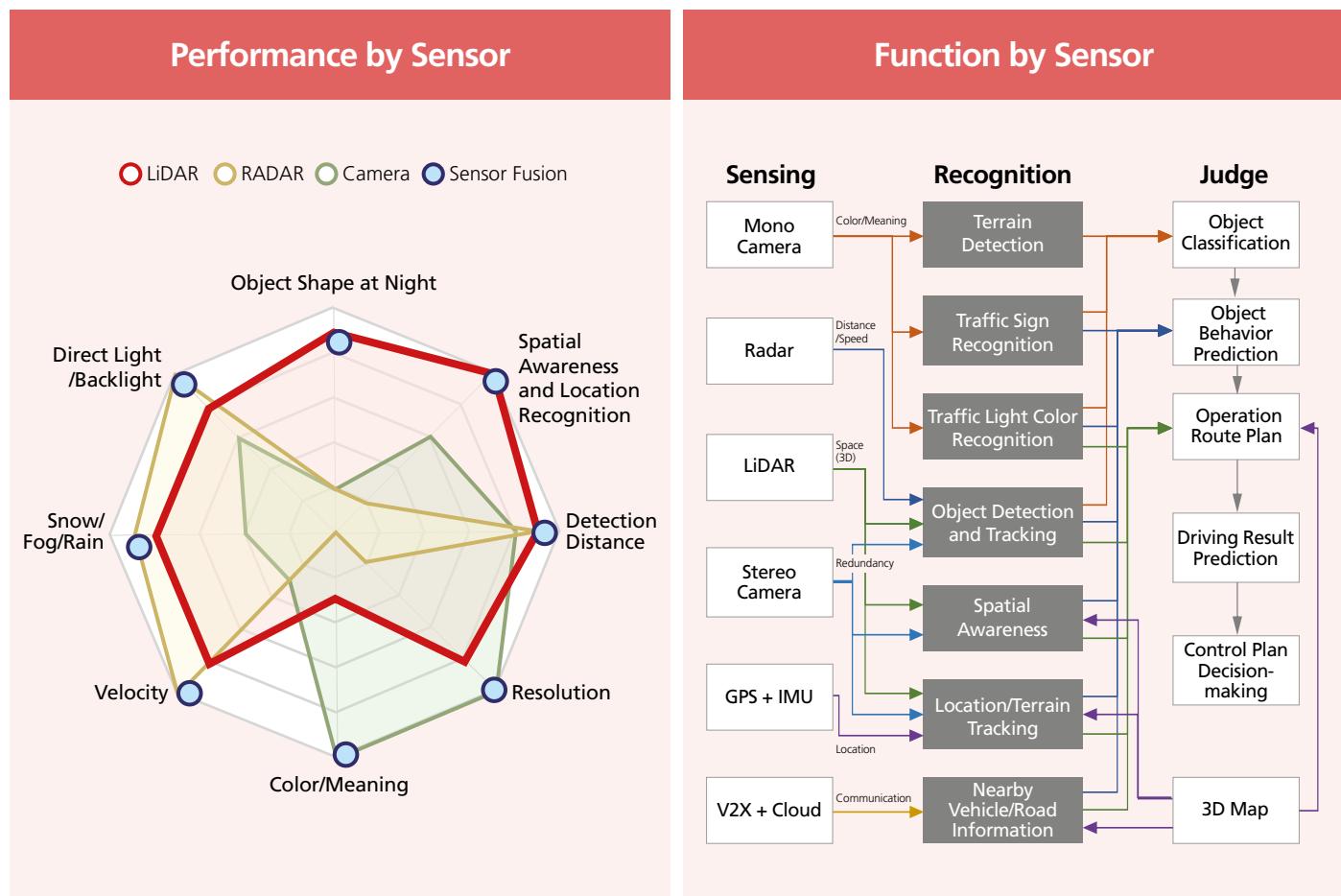
LG Innotek optimized the overall value chain by adopting AI and other digital technologies, making it an ideal partner in the LiDAR business. Its digital design and verification software based on the Digital Twin model, enables the company to design and examine the product virtually. The company's smart factory also increases productivity and product quality by actively responding to ongoing changes in the manufacturing process.





## Providing Integrated Autonomous Driving Solutions

As shown in the graph below, a provider's ability to offer impeccable performance by combining various sensors and connectivity modules is critical for self-driving solutions. Following over ten years of experience in smartphone camera module and car component production, LG Innotek shares its expertise as a leader in producing connectivity modules and sensors for self-driving solutions such as LiDAR, Camera and RADAR.



In addition to autonomous driving solutions, LG Innotek has a wide lineup of automotive components.

### Motor Solutions

Motor /ECU<sup>9</sup> for Electric Power Steering (EPS)  
Gear Integrated Module for EHB<sup>10</sup> /EMB<sup>11</sup>  
Motor for Dual-clutch Transmission (DCT<sup>12</sup>)  
Sensor for Steering System (TAS<sup>13</sup> /TOS<sup>14</sup> /TIS<sup>15</sup>)

### Power Solutions

Battery Management System  
DC-DC Converter  
Electric Vehicle Communication Controller

### Lighting Solutions

LED Module for Automotive  
LED Driver Module



## Coming Up Next

In upcoming newsletters, we'll discuss autonomous vehicles and automotive components touching on high resolution camera and connectivity modules. The series will deliver a detailed look at the trend of the technologies and the future-forward, high-tech innovations LG Innotek is applying to their mass production and commercialization.

## About LG Innotek Co., Ltd.

LG Innotek, Korea's first electronic components company, founded in 1970, has grown into a leading global material and component company by intensely fostering world-class products through continuous technological development and process innovations.

We supply global customers with critical materials and components across the mobile, display, semiconductor, automotive, and IoT industries. Our state-of-the-art, global product offering includes smartphone camera modules, substrates and photomasks for display, and semiconductor substrates for communication. These products are developed and produced at our business sites, both home and abroad.

LG Innotek optimized the overall value chain by adopting AI and other digital technologies, making us a sought-after partner for LiDAR business. Our Digital Twin software allows virtual design and examination of products, and our smart factories increase overall productivity and product quality.

We will achieve our vision of becoming the Global No.1 Material and Component Company through meaningful and unique technological innovation and convergence.

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Headquartered in Seoul, South Korea, LG Innotek also has sales subsidiaries located in the United States, Germany, China, Japan, and Taiwan, as well as production subsidiaries in China, Vietnam, Indonesia, Mexico, and Poland. For more information, please visit our website: [www.lginnotek.com](http://www.lginnotek.com).

## Contact Point

### **LG Innotek USA Inc.**

⌚ 2540 N 1st ST STE 400, SAN JOSE, CA 95131-1016, USA  
✉ jeonggiseo@lginnotek.com

### **LG Innotek Co., Ltd. Europe Branch**

⌚ Am Limespark 2 (Innovapark) 65843 Sulzbach am Taunus, Germany  
✉ thomas.hausmann@lginnotek.com

### **LG Innotek Co., Ltd.**

⌚ E1/E3, 30, Magokjungang 10-ro, Gangseo-gu, Seoul, 07796, Korea  
✉ lgit.lidar@lginnotek.com



[www.lginnotek.com](http://www.lginnotek.com)